Thermalito Afterbay Water Temperature Improvements: Construct Facilities to Convey Cold Water Directly to TAB Outlet Facility

1. Resource Action Description:

To improve water temperatures to accommodate aquatic species and agricultural diversions, a proposal under consideration is construction of open channel conveyance facilities from an area in the north afterbay near theThermalito Pumping-Generating Plant to an area in the south afterbay near the Thermalito Afterbay Outlet. A system of small dams and dikes is also proposed to develop pools that may provide warmer water for agricultural diversions.

2. Project Nexus:

Under existing environmental commitments the Department of Water Resources operates the Oroville Facilities to meet temperature objectives in the Feather River for aquatic species survival. This Resource Action could potentially provide cold water directly from Thermalito Afterbay to the Feather River.

3. Potential Benefits:

DWR will continue to work with State and federal fishery resource agencies to develop temperature objectives for the Feather River that provides benefits for aquatic species survival and their habitat.

Construction of the proposed open channel conveyance facilities would isolate cold water that enters the afterbay through the Thermalito Pumping-Generating Plant for direct outflow through Thermalito Afterbay Outlet to the Feather River.

Warmer water may become available in Thermalito Afterbay once the proposed open channel conveyance facilities are completed. Warmer water pools could potentially be available to provide warm water diversions for agricultural use.

4. Potential Constraints:

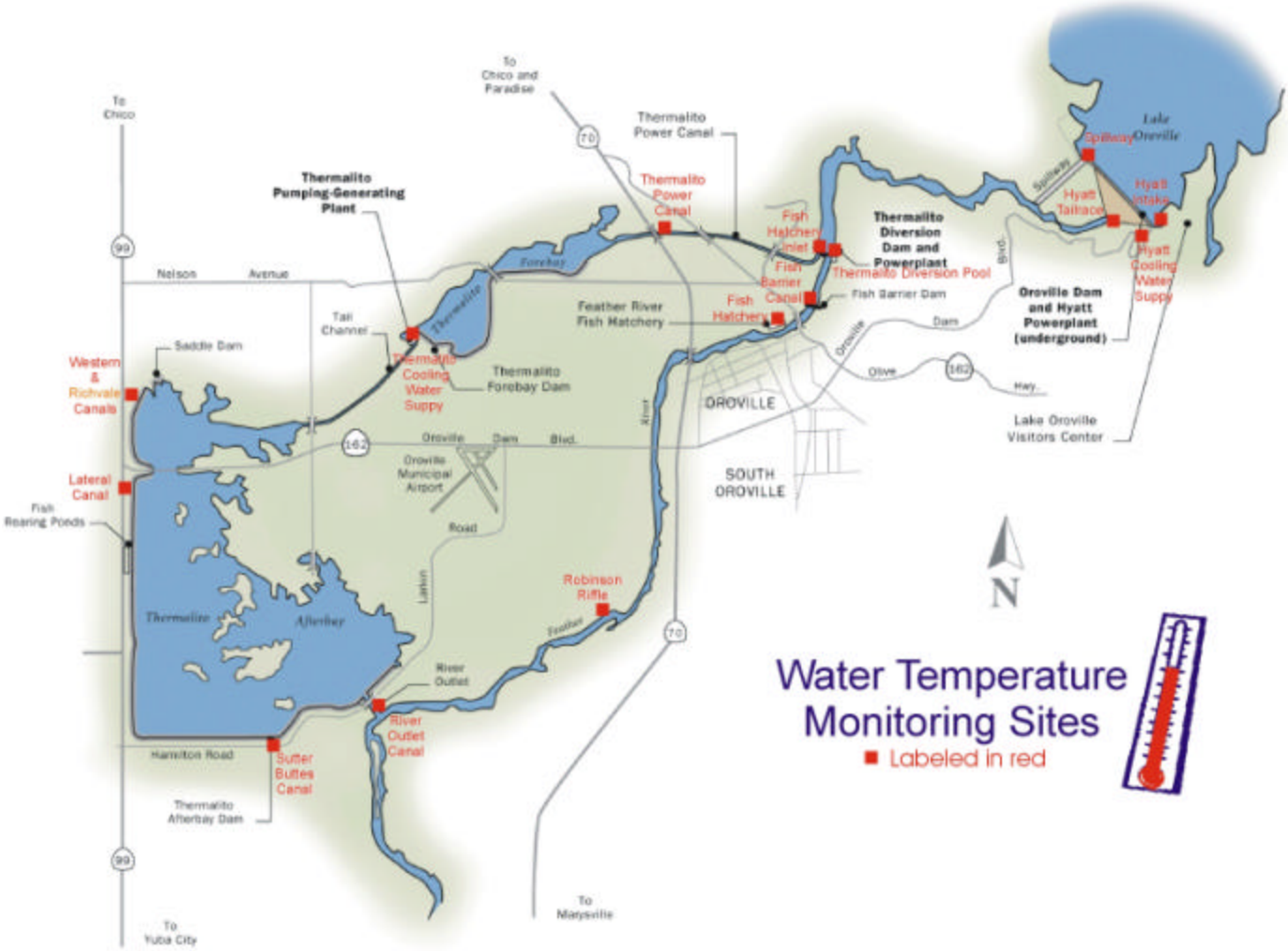
Constructing the proposed open conveyance channel to transport water from Thermalito Pumping-Generating Plant to the Thermalito Afterbay Outlet vicinity will have to be studied to ensure minimum disturbance to the existing environment.

Construction activities resulting from building the proposed open channel conveyance facilities could potentially result in major environmental impacts in the area during the construction period as well as when routine maintenance activities are performed.

Financing the construction costs associated with the proposed facilities would have to be considered as well as cost sharing among the entities benefiting from the proposed open channel conveyance facilities.

5. Existing Conditions:

Beginning in May 2002, DWR began collecting water temperature data in Thermalito Afterbay. Water temperature monitoring stations were placed at Thermalito Pumping-Generating Plant tailrace, Richvale Canal, Western Canal Lateral, Western Canal Main, Sutter Butte Canal, and Thermalito Afterbay Outlet.

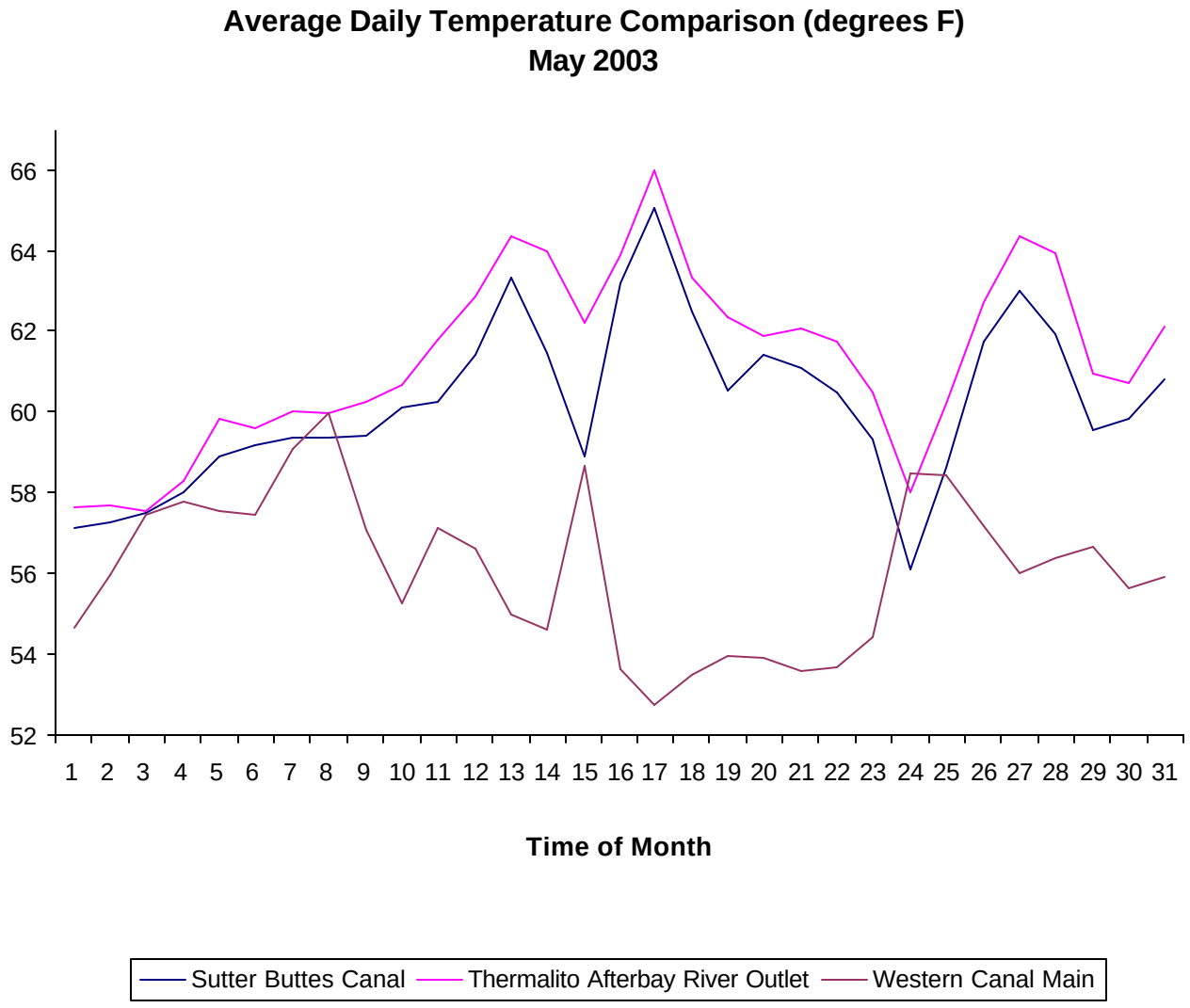


DWR has a complete data set for actual Thermalito Afterbay water temperatures at each facility mentioned above for calendar year 2003. There were some missing data for Thermalito Afterbay water temperatures for calendar year 2002. Thermalito Afterbay average daily temperatures and diversion flows for July and August for calendar year 2002 are shown in Appendix A.

Actual water temperature data obtained for each monitoring station shows cooler water in May 2003 overall and a warming trend typically begins in June 2003 and continues through August 2003. The data also show that as diversions increase over a period of

several days that the water temperature at the agricultural diversion points decrease; this is particularly apparent at the Western Lateral Canal diversion as shown in Appendix B. The water temperature decreases suggest the warmer water is getting replaced by colder reservoir releases that are necessary to meet agricultural diverters' water demands from Thermalito Afterbay.

The figure below shows the actual average daily water temperatures for Sutter Buttes Canal, Western Canal, and Thermalito Afterbay Outlet for May 2003.

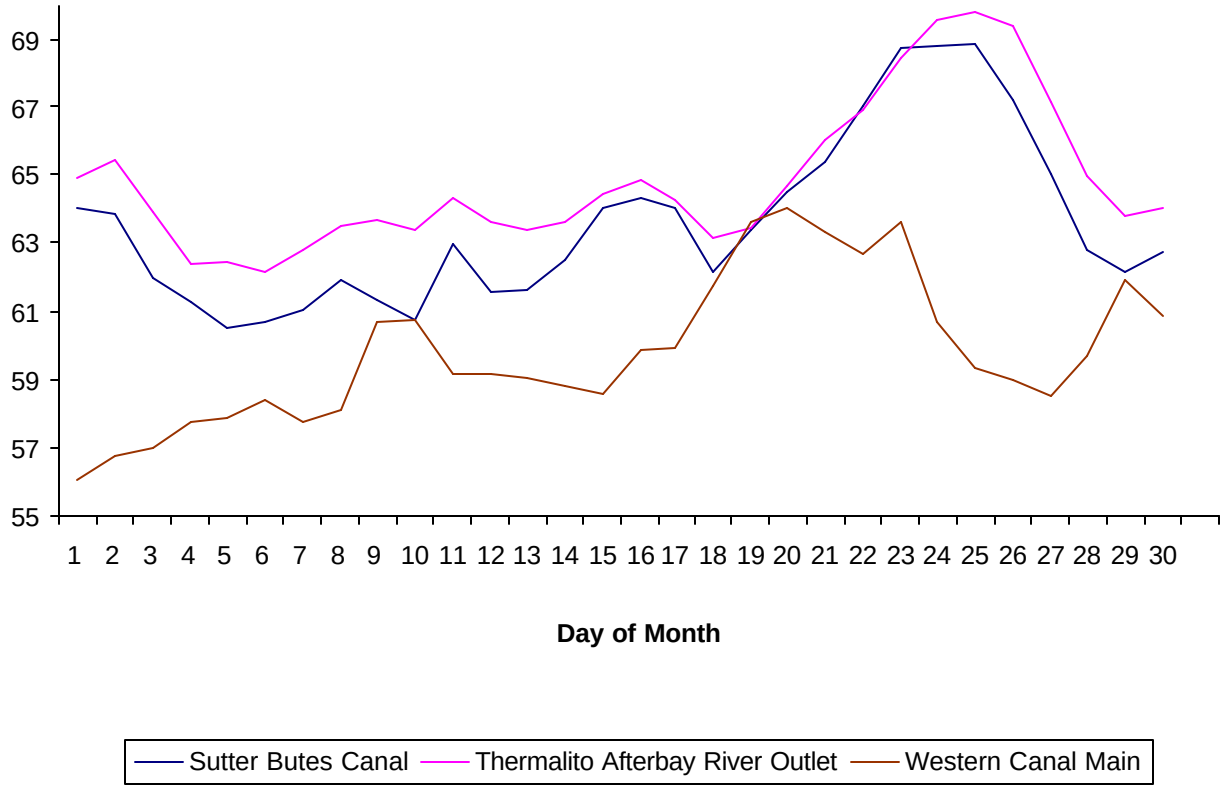


The average daily water temperature for Sutter Buttes Canal seems to track relatively closely with the temperatures of Thermalito Afterbay Outlet. Differences in average daily temperatures between Western Canal Main and Thermalito Afterbay Outlet can, for the most part, be described as representing a diverging trend. The maximum average daily temperature differences range between about 4 ^{o}F and 14 ^{o}F. It is

suspected that ambient conditions play a significant role early in the spring when air temperatures remain relatively low. As air temperature increases, residence time in the afterbay becomes a dominant factor; thus, the difference in the temperature of water that enters the afterbay at the power plant and leaves the afterbay at the outlet increases through the month.

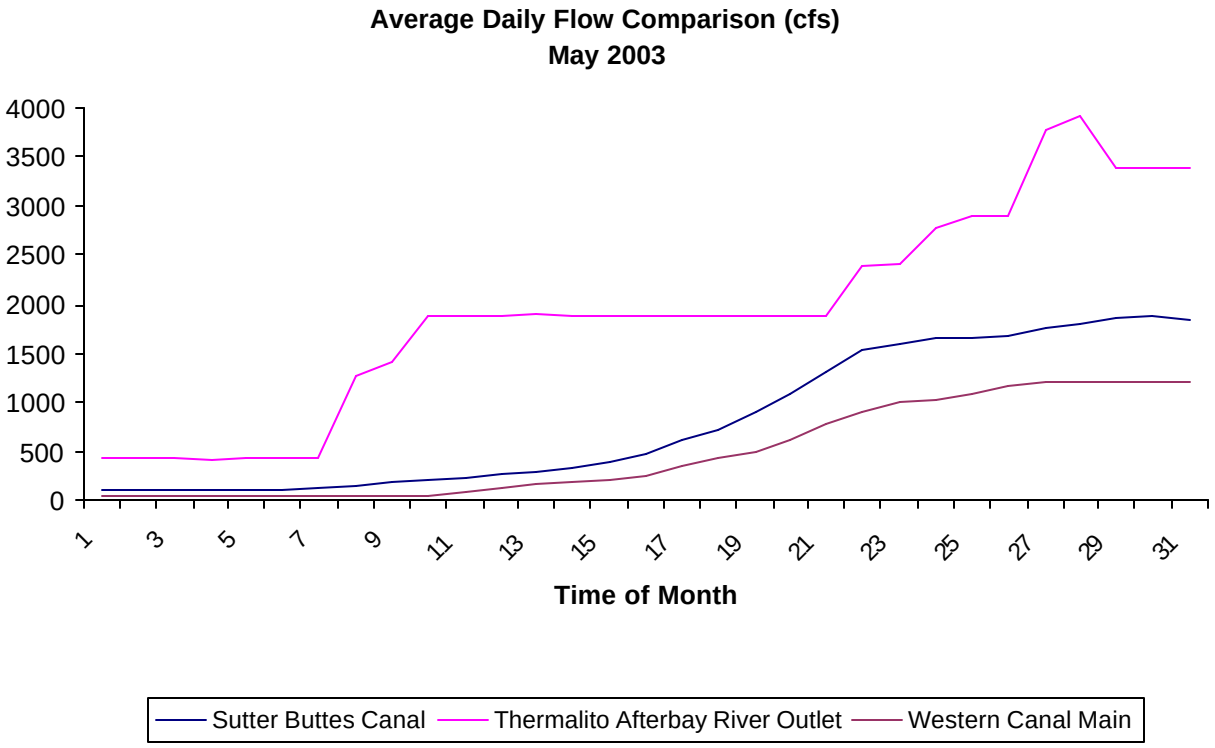
A different pattern for the average daily water temperature difference is observed for June 2003 and is shown in the figure below.

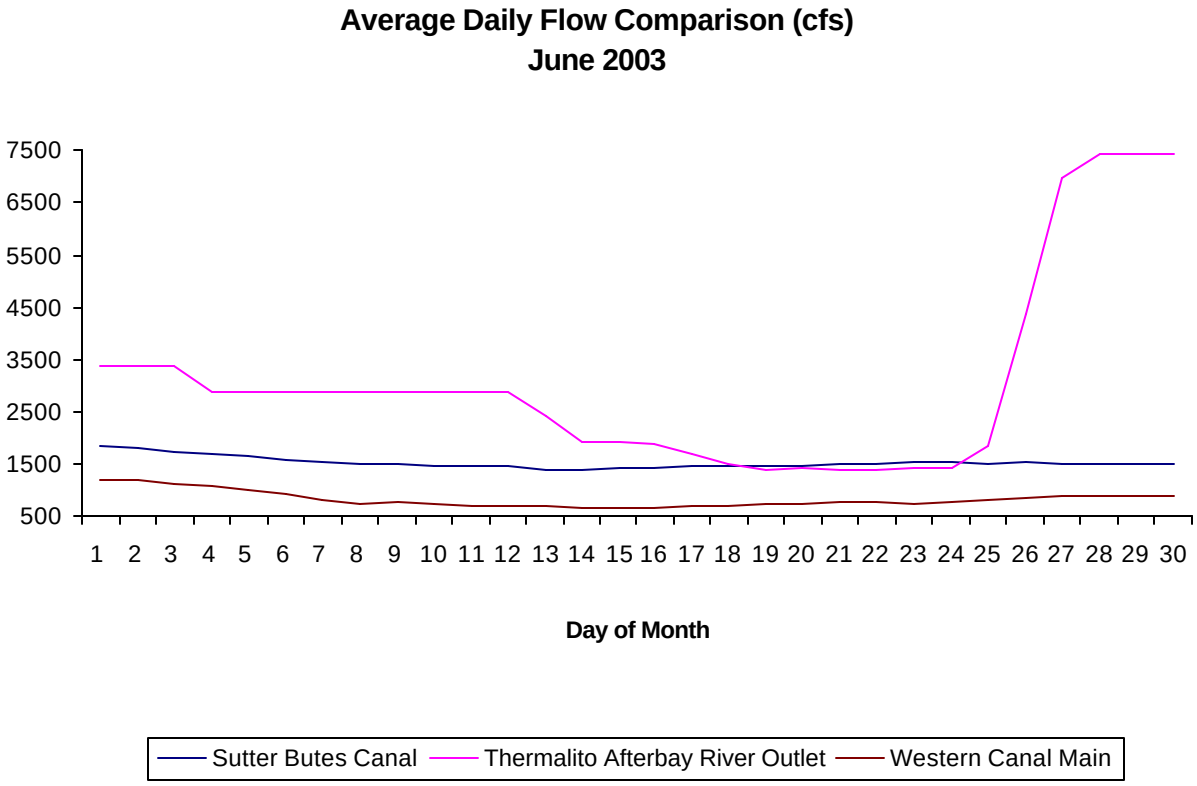
Average Daily Temperature Comparison (degrees F)
June 2003



It appears that when agricultural diversions increased during June 2003, water temperatures remained cool due to subsequent shorter water residence time in Thermalito Afterbay. Measured temperatures at Thermalito Afterbay Outlet seem to be generally warmer than those at the Sutter Buttes Canal and Western Canal Main.

The average daily diversion flows for May 2003 and June 2003 are shown in the figures below.


Average Daily Flow Comparison (cfs)
May 2003
4000
3500
3000
2500
2000
1500
1000
500
0
1
3
5
7
9
11
13
15
17
19
21
23
25
27
29
31
Time of Month
Sutter Buttes Canal
Thermalito Afterbay River Outlet
Western Canal Main


Average Daily Flow Comparison (cfs)
June 2003
7500
6500
5500
4500
3500
2500
1500
500
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day of Month
Sutter Butes Canal
Thermalito Afterbay River Outlet
Western Canal Main

Appendix C shows average daily temperatures and diversion flows for July and August during calendar year 2003.

6. Design Considerations and Evaluation:

DWR's Division of Engineering is performing an initial estimate of cost for several design options for the proposed open channel conveyance facilities and system of small dams and dikes. The cost information along with the water temperature data that have been collected in the field are the basis for a reconnaissance-level evaluation of the potential changes in water temperatures. Other reconnaissance-level analyses regarding environmental and recreational impacts may be necessary before staff could provide a recommendation to DWR management. Still, on the basis of potential changes in temperature, this resource action shows promise.

7. Synergism and Conflicts:

This proposed resource action provides an excellent opportunity to potentially improve water temperatures from Thermalito Afterbay Outlet for aquatic species and their habitat. In addition, this proposed resource action may potentially improve water temperatures for the benefit of agricultural diversions from Thermalito Afterbay.

Environmental impacts in the immediate area of the proposed open channel conveyance facilities and system of small dams and dikes will have to analyzed as well as potential mitigation options.

Recreation activities in the Afterbay may also be impacted due to the proposed open channel conveyance facilities and system of dams and dikes. Public safety issues must also be considered and analyzed regarding this proposed resource action.

8. Uncertainties:

A major challenge for considering this proposed resource action is cost and financing. DWR must consider means by which the construction costs will be financed and repaid. It is likely that financing and repayment of this proposed resource action will be a subject of settlement negotiations.

9. Cost Estimate:

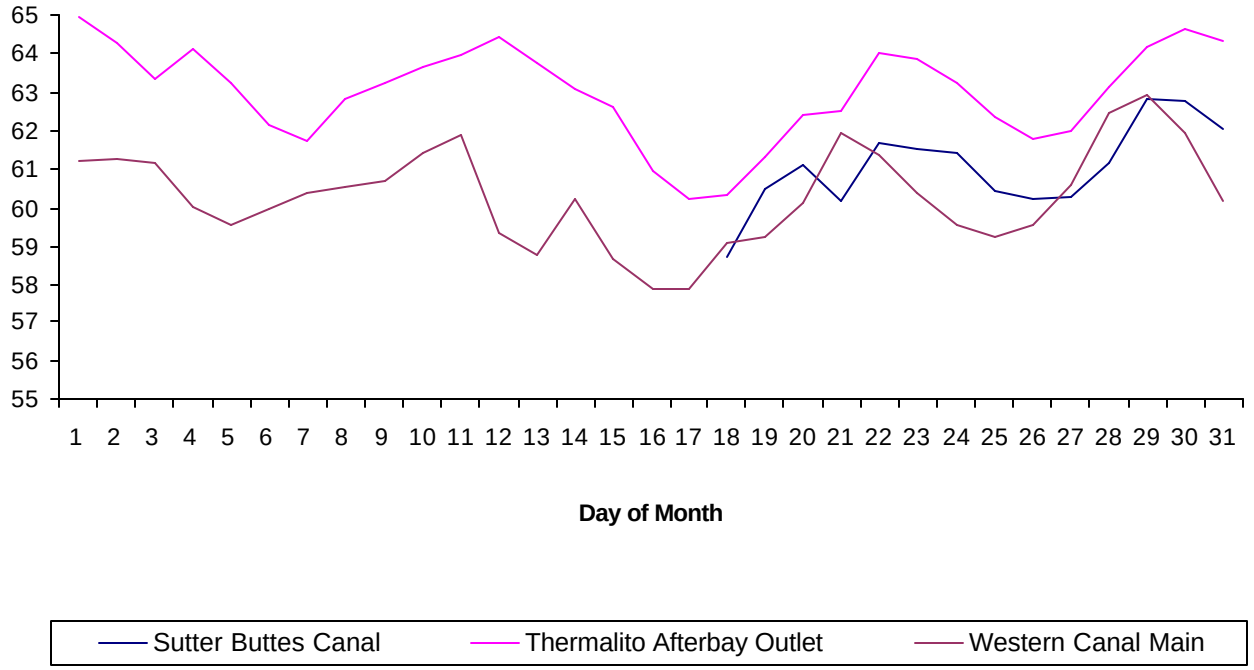
DWR's Division of Engineering is currently reviewing the cost of several options for designing the proposed open channel conveyance facilities and system of small dams and dikes.

10. Recommendations:

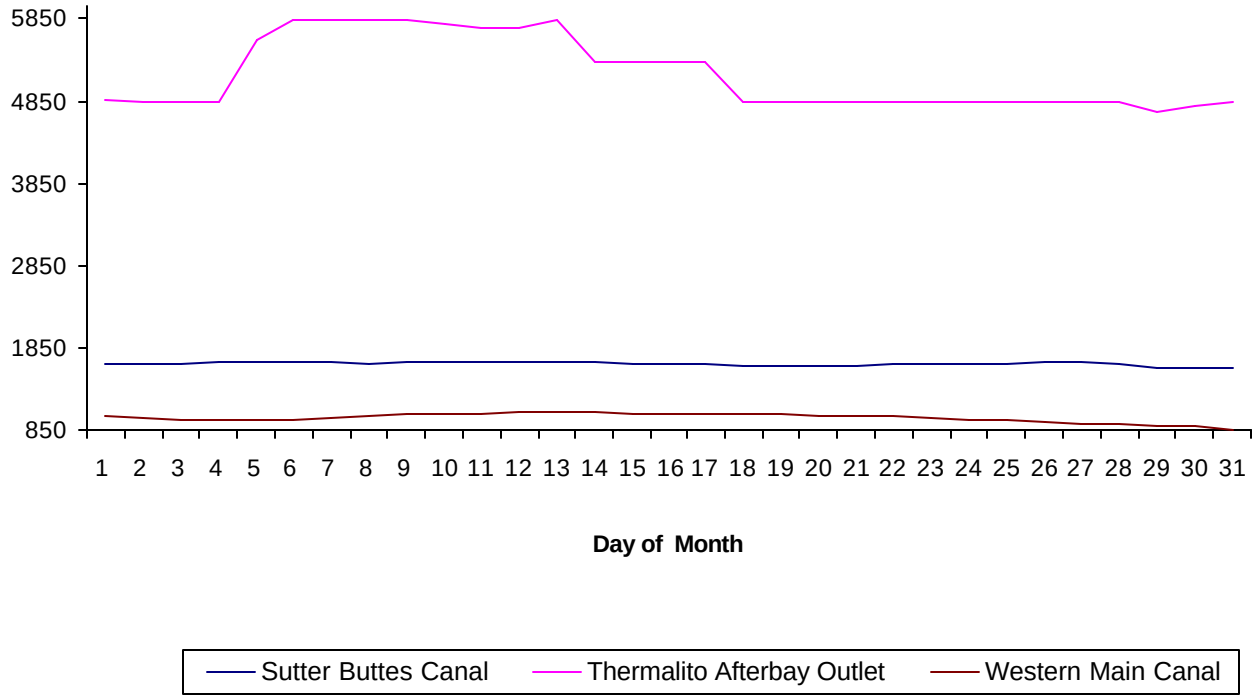
The Engineering and Operations Work Group recommends DWR staff develop an initial analysis that considers the best option to pursue this proposed resource action for DWR management consideration.

Appendix A
Thermalito Afterbay
Average Daily Temperatures and Flow
July 2002
August 2002

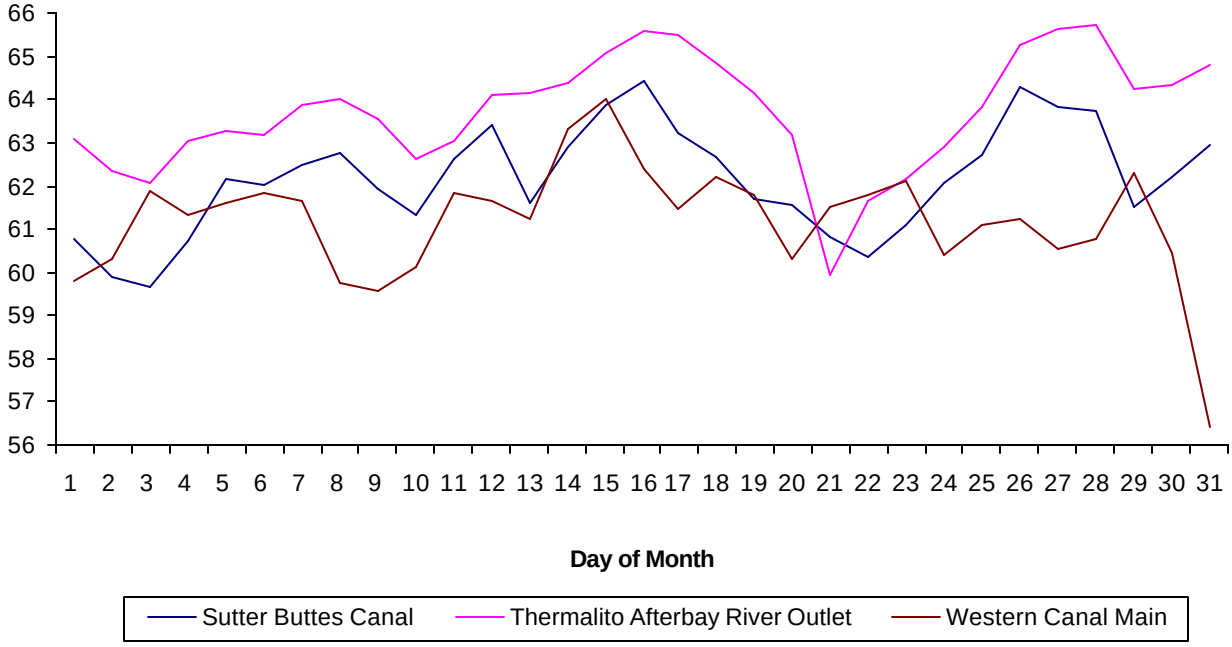
Average Daily Temperature Comparison (degrees F)
July 2002



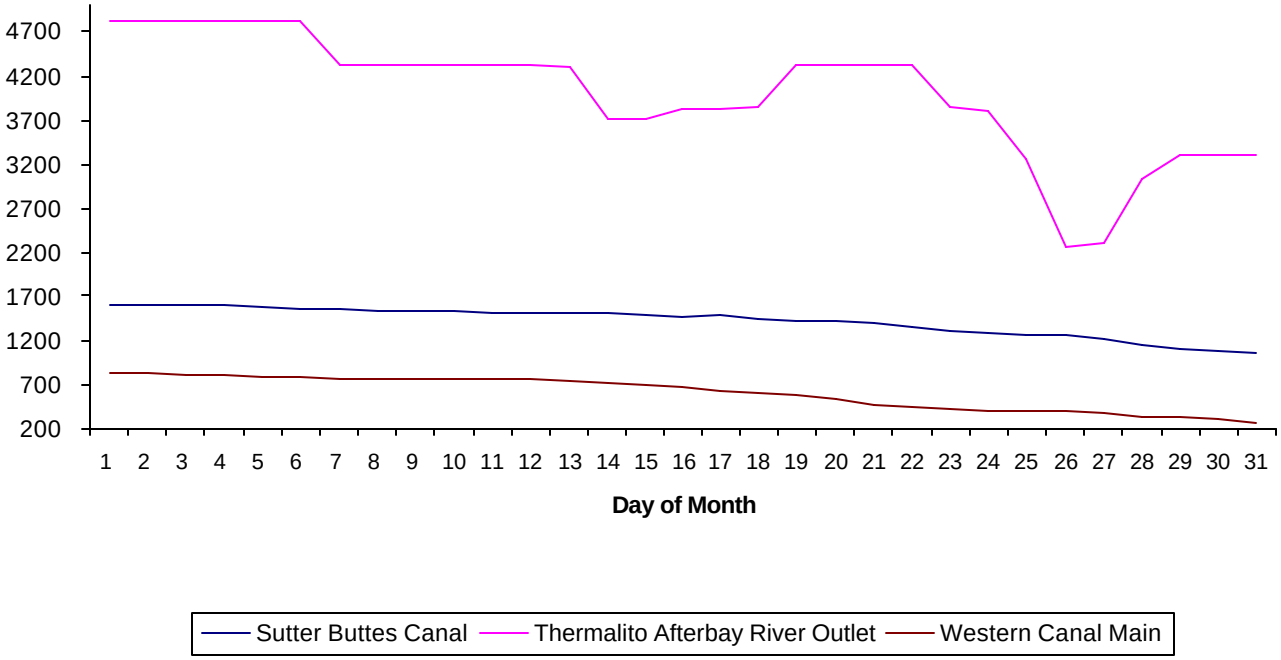
Average Daily Flow Comparison (cfs)
July 2002



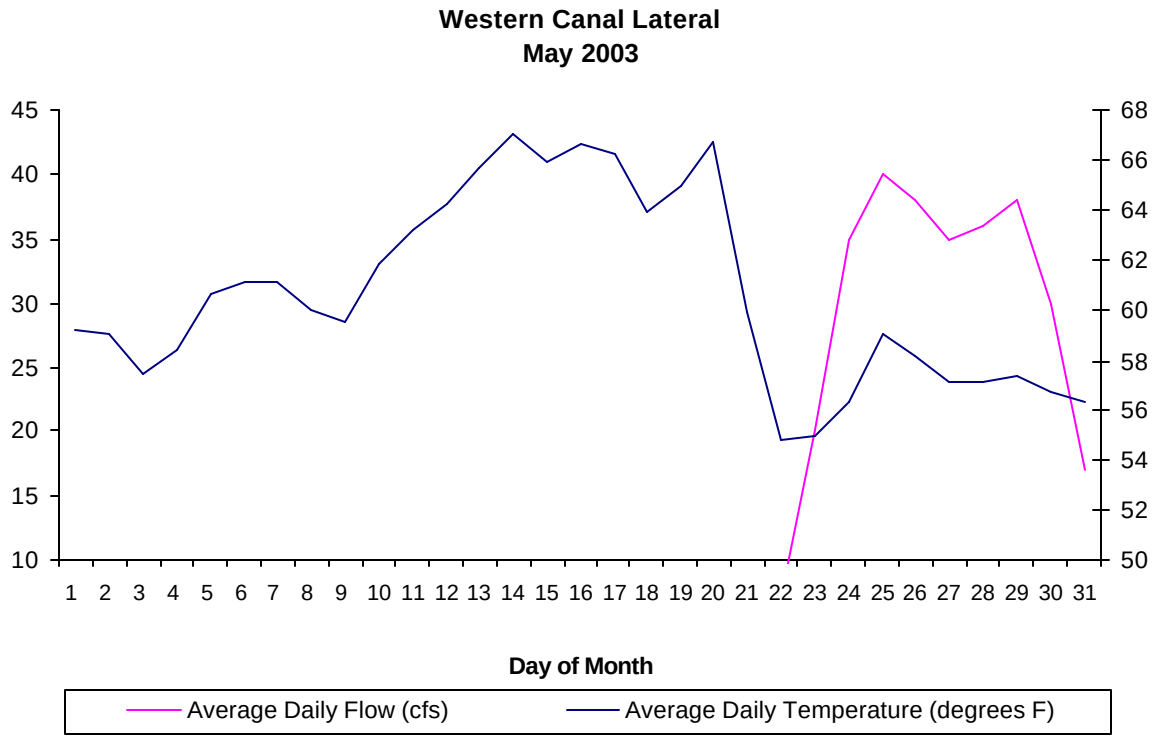
Average Daily Temperature Comparison (degrees F)
August 2002

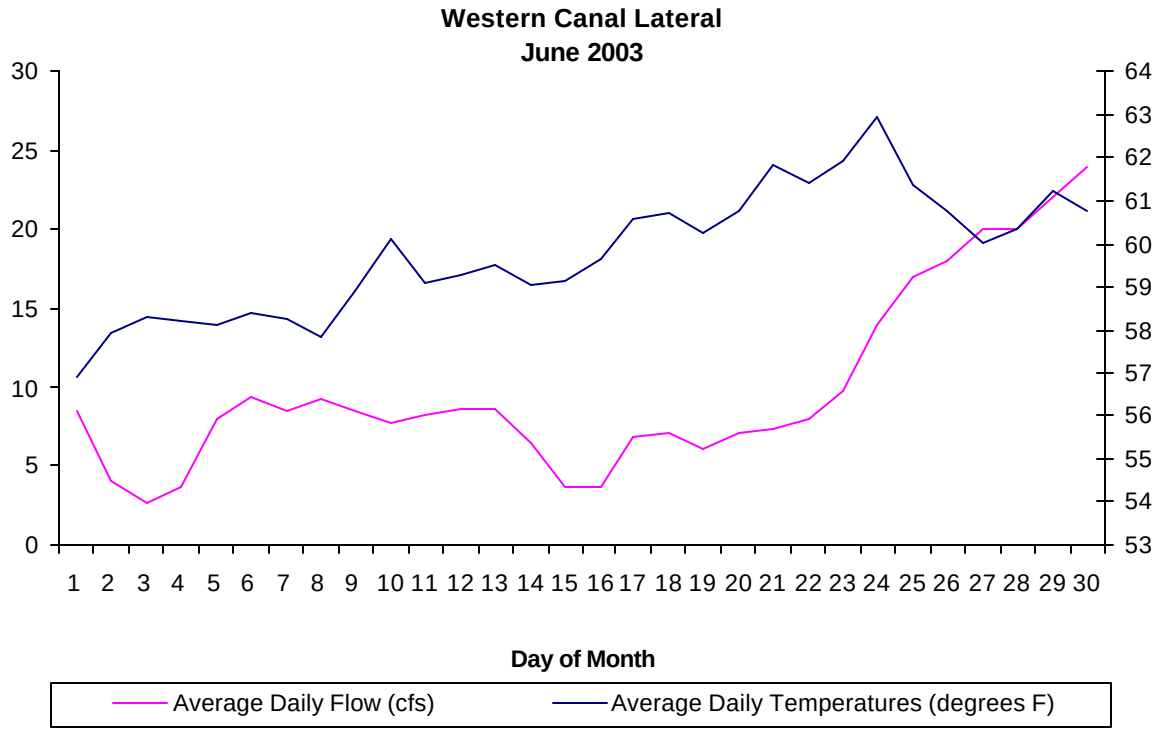


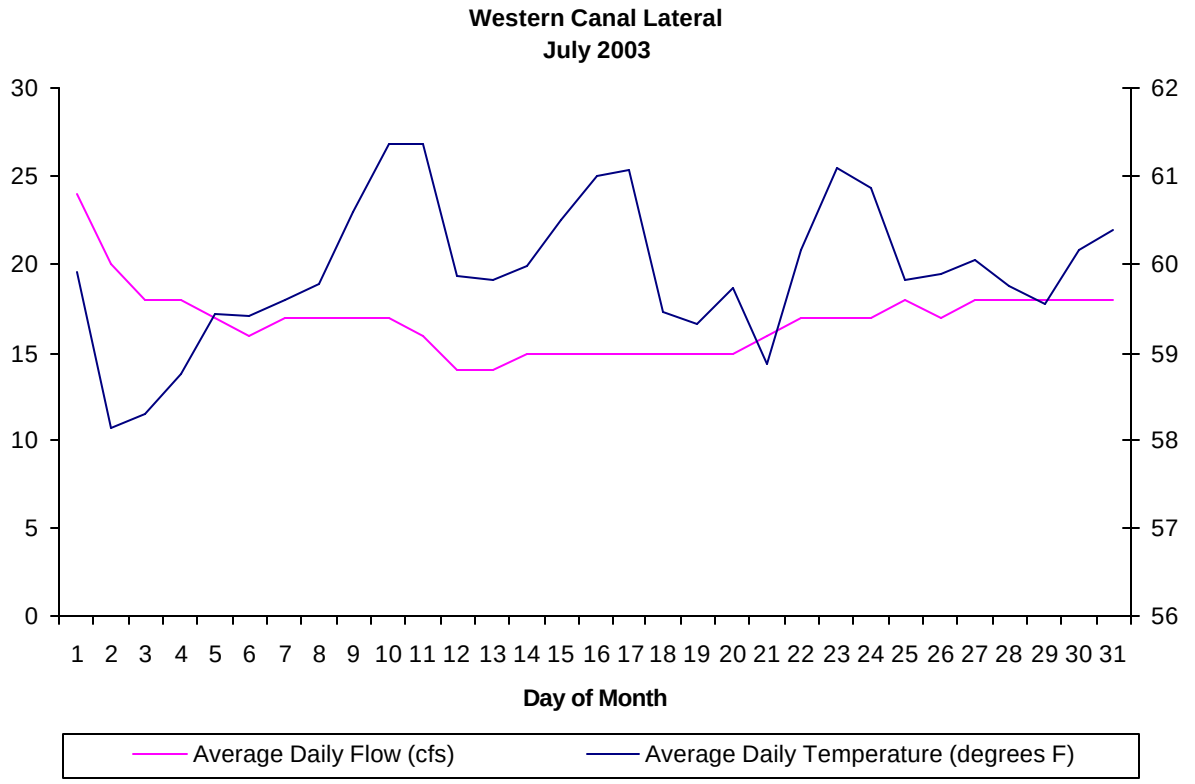
Average Daily Flow Comparison (cfs)
August 2002

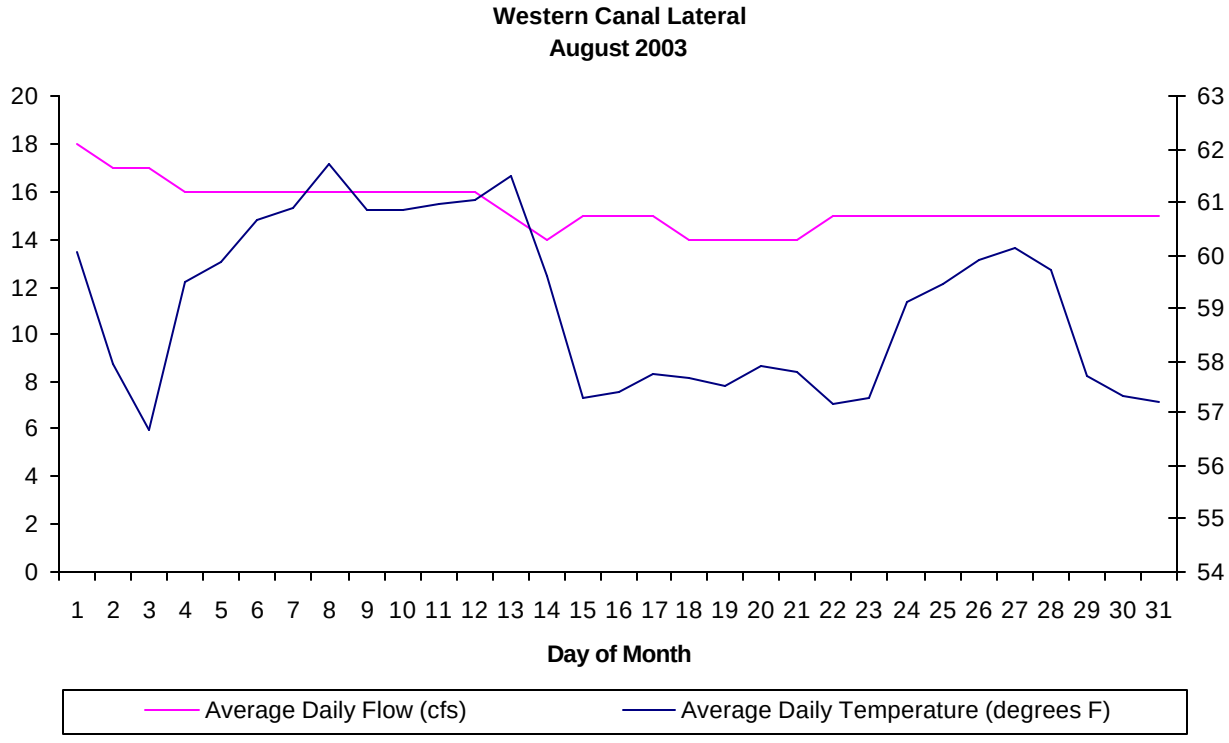


Appendix B
Western Canal Lateral
Average Daily Temperatures and Flow


Western Canal Lateral
May 2003
45
40
35
30
25
20
15
10
68
66
64
62
60
58
56
54
52
50
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
Average Daily Flow (cfs)
Average Daily Temperature (degrees F)

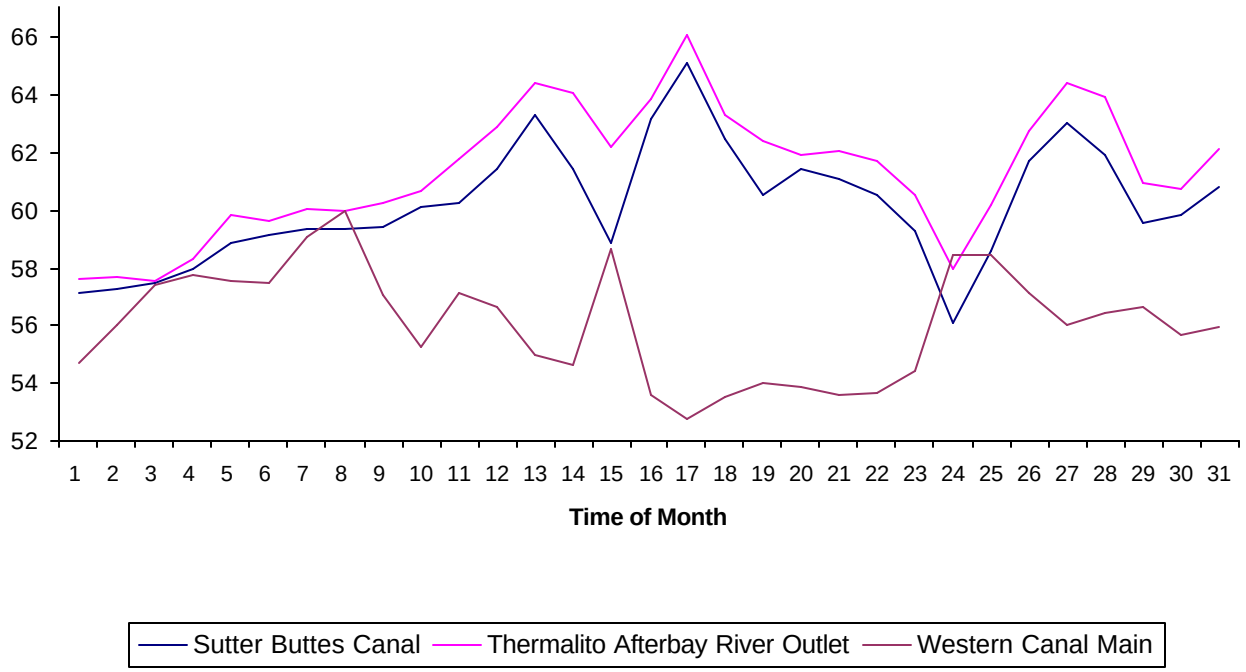

Western Canal Lateral
June 2003
30
25
20
15
10
5
0
64
63
62
61
60
59
58
57
56
55
54
53
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Day of Month
Average Daily Flow (cfs)
Average Daily Temperatures (degrees F)


Western Canal Lateral
July 2003
30
25
20
15
10
5
0
62
61
60
59
58
57
56
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
Average Daily Flow (cfs)
Average Daily Temperature (degrees F)

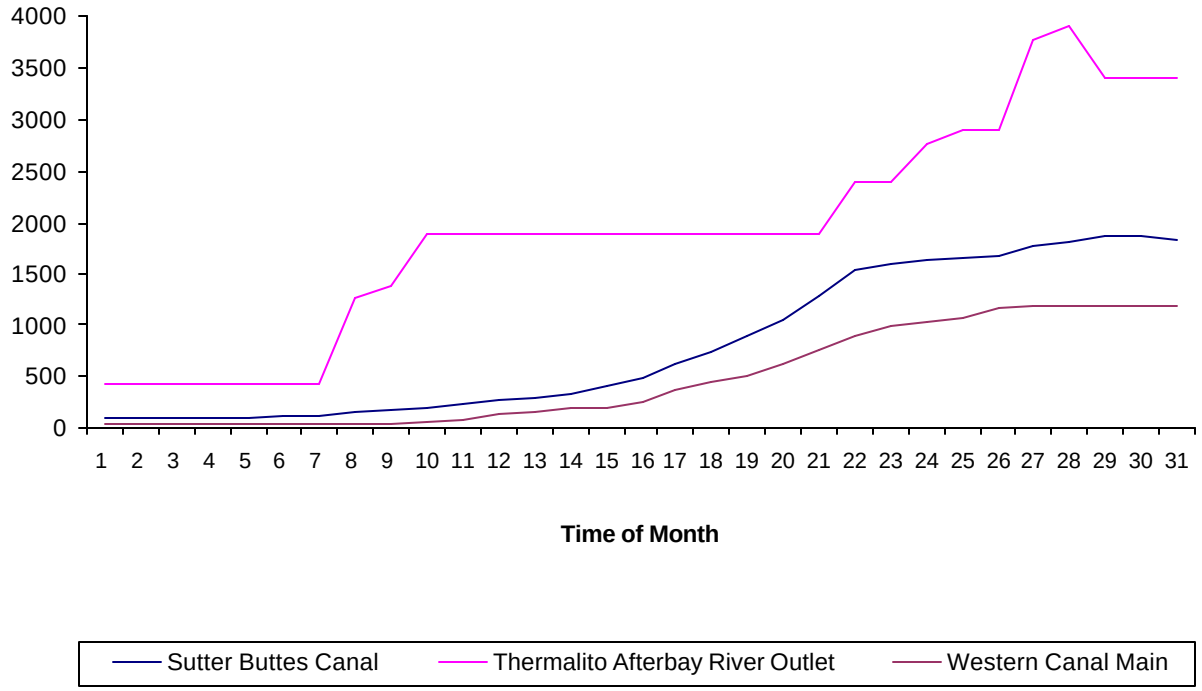

Western Canal Lateral
August 2003
20
18
16
14
12
10
8
6
4
2
0
63
62
61
60
59
58
57
56
55
54
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
Average Daily Flow (cfs)
Average Daily Temperature (degrees F)

Appendix C
Thermalito Afterbay
Average Daily Temperatures and Flow
May 2003
June 2003
July 2003
August 2003

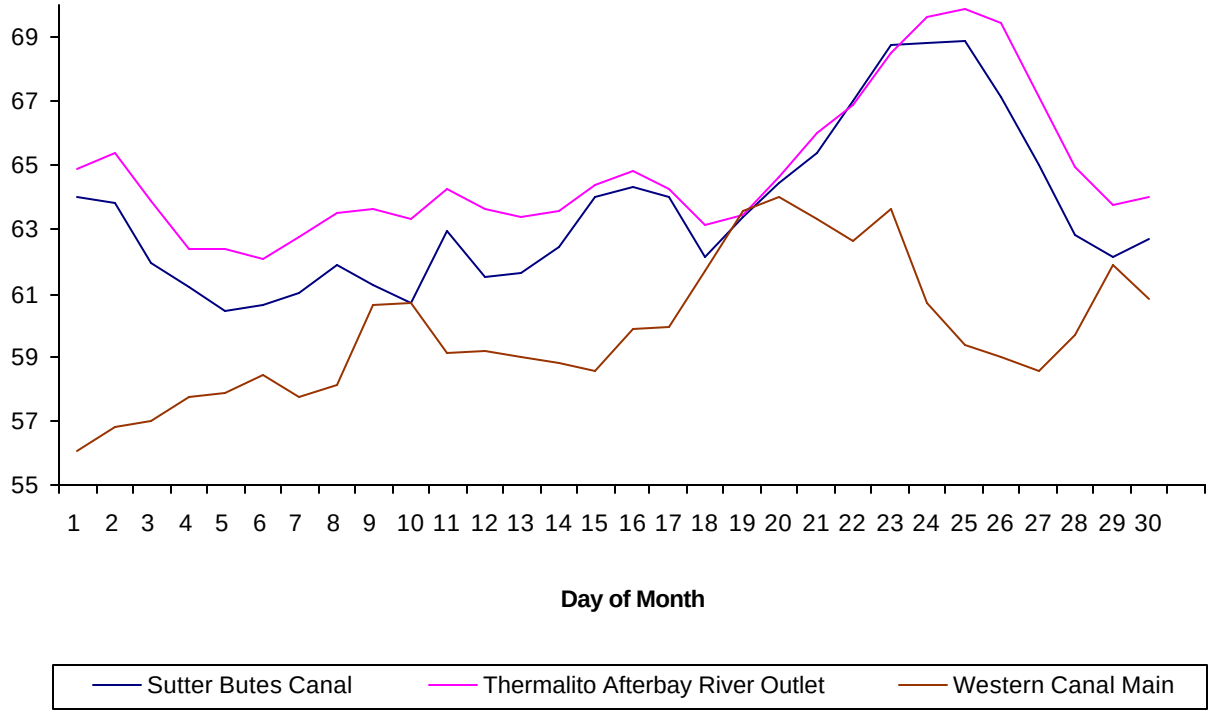
Average Daily Temperature Comparison (degrees F)
May 2003



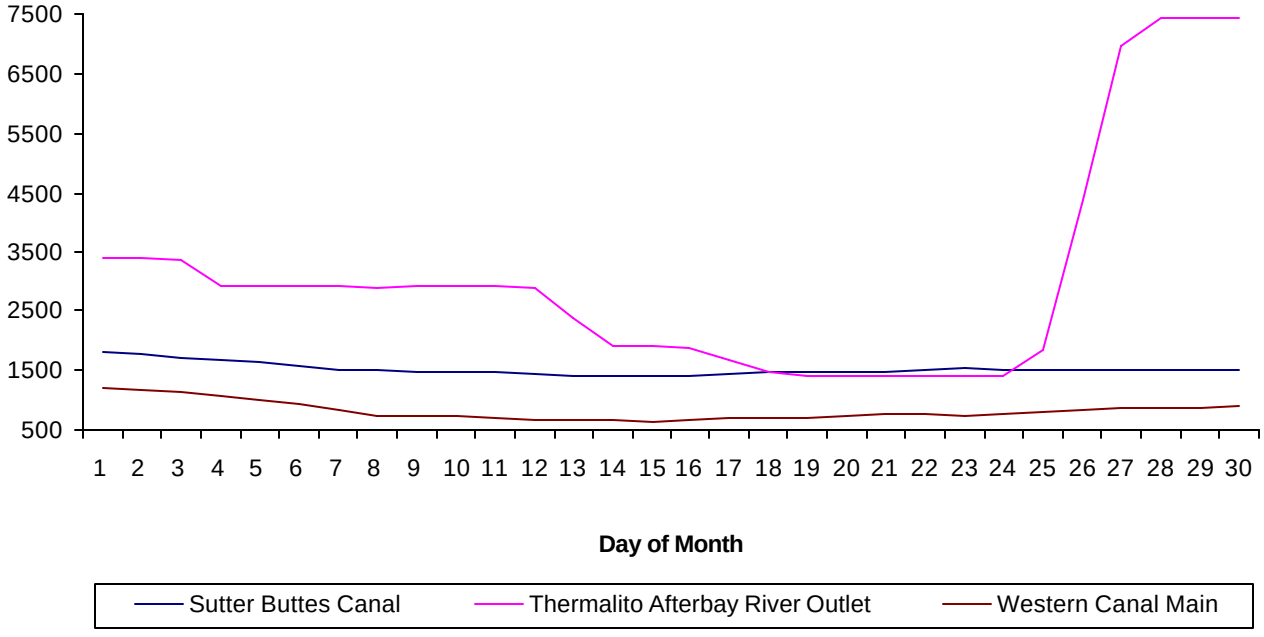
Average Daily Flow Comparison (cfs)
May 2003



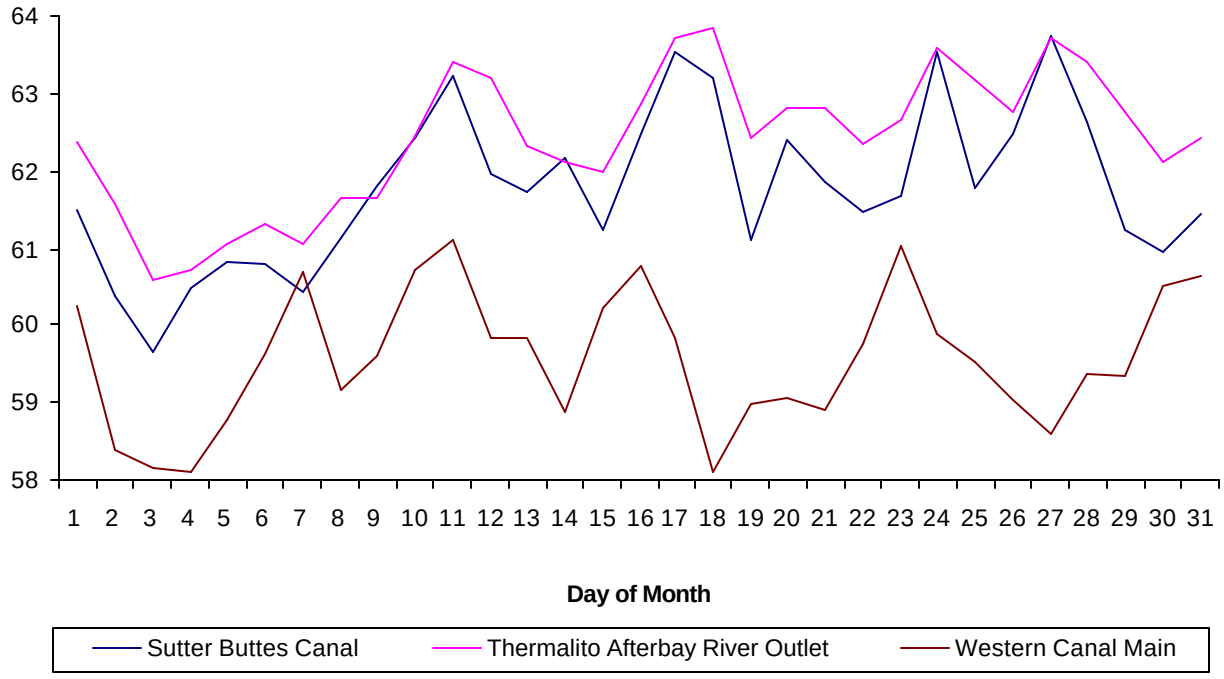
Average Daily Temperature Comparison (degrees F)
June 2003



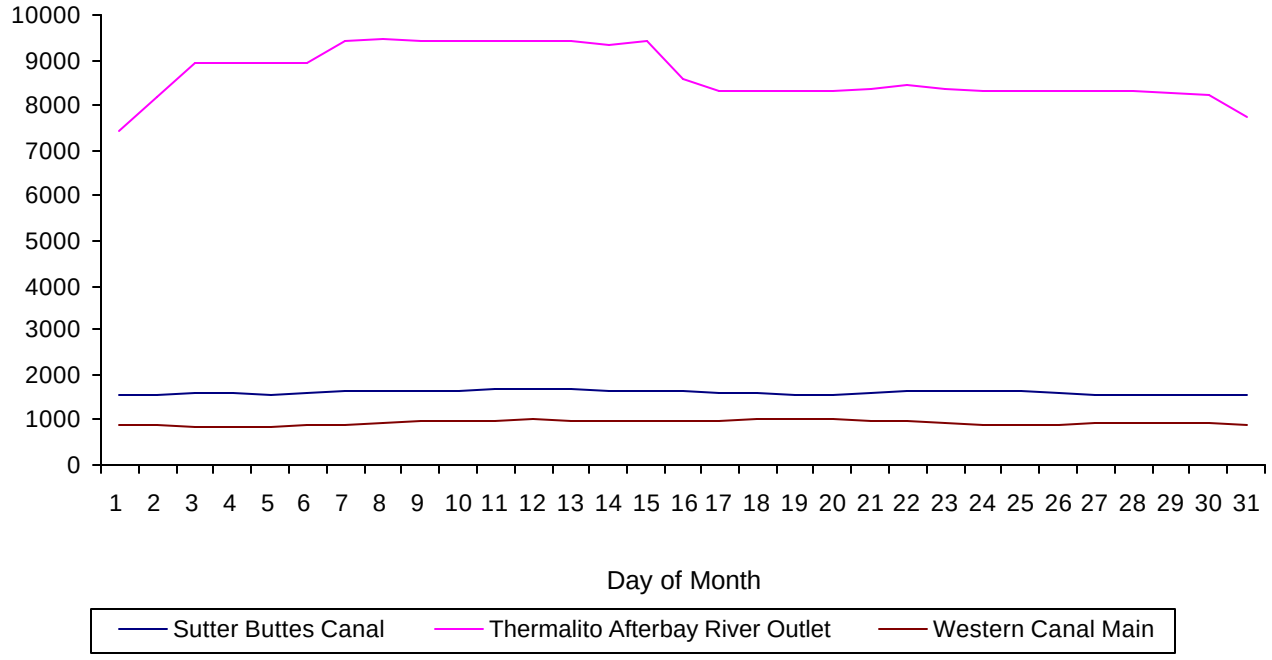
Average Daily Flow Comparison (cfs)
June 2003



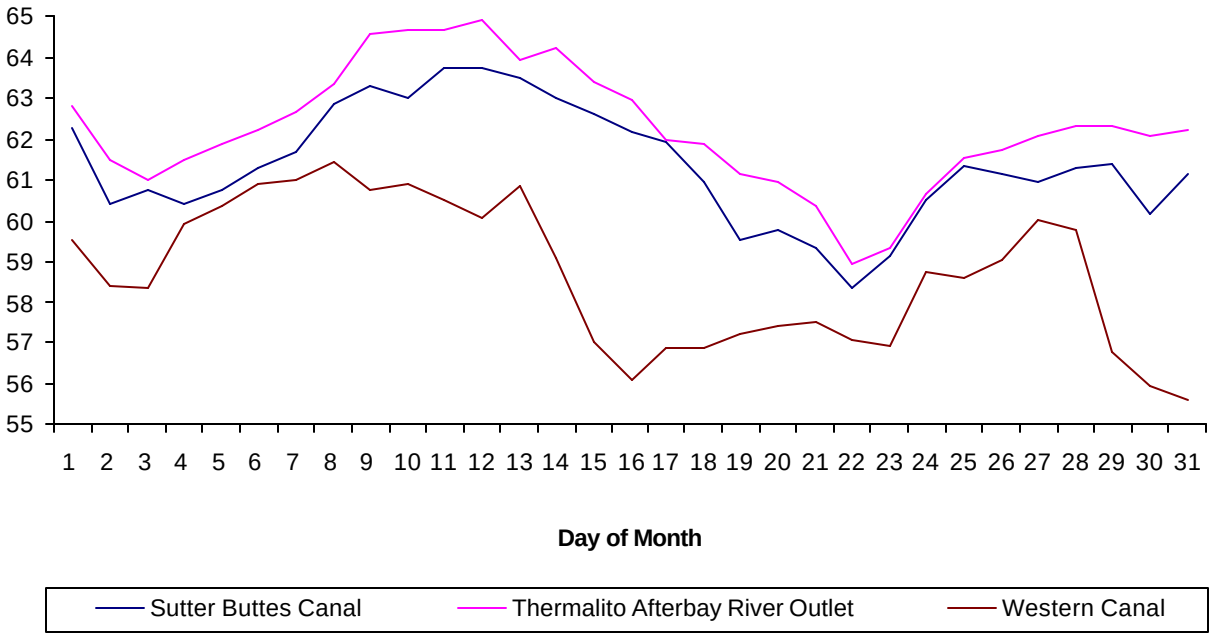
Average Daily Temperature Comparison (degrees F)
July 2003



Average Daily Flow Comparison (cfs)
July 2003



Average Daily Temperature Comparison (degrees F)
August 2003



Average Daily Flow Comparison (cfs)
August 2003